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Applications of Remote Sensing:

Aspects of the BLM Wildland Vegetation Resource Inventory Project

by

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Table of Contents

Page

1.0 Introduction 1

2.0 Description of the Wildland Vegetation Resource Inventory Program . . 2

3.0 Wildland Vegetation Resource Inventory Program and SVIM 3

4.0 Technology Applications 4

5.0 Scales, Mapping Minimums, and Projections 19

6.0 Cost Information 19

1.0 Introduction

This report discusses several aspects of the BLM-NASA-EROS Wildland Vegetation Resource Inventory Program which have been sufficiently developed and acceptance tested for routine use in BLM field offices. The report itself evolved from a directive issued by the Information Management System Steering Committee.* In March 1980 the Steering Committee conducted a review of this program and concluded from the review that certain aspects of the technology could be useful to BLM field offices. Specifically it was decided that those aspects of the program which apply to broad regional planning and Unit Resource Analysis (URA) were immediately applicable. Consequently the Denver Service Center (DSC) was directed to prepare a report to the field detailing those facets of the program which could be used within the frame work of the Planning System (specifically URA). It is to be emphasized that this report is not a directive to use this technology. Rather it is a document informing the field that those aspects of the technology herein specified are now operational and may be used at the discretion of the field.

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* The BLM Washington Office Steering Committe composed of the Deputy Directors, Assistant Directors, and chaired by the Deputy Director for Services.

2.0 Description of the Wildland Vegetation Resource Inventory Program

The Wildland Vegetation Resource Inventory Program was initiated four years ago (1976). The program was a joint effort by BLM, NASA, and EROS to evaluate the utility of remote sensing and multiphase sampling for application to the BLM Planning System. Principle emphasis of the program was directed to URA and broad regional inventories. Test sites in Alaska, Arizona, and Idaho were selected for the assessment process. This report is based on results from Alaska and Arizona and partial results from Idaho.

The technology applied, utilizes Landsat**, subsamples of aerial photographs*** and ground information**** to categorize broad inventory information. This information is then synthesized into a digital data base where it is further joined with ancillary data on the same geographic area. Examples of ancillary data are soils, precipitation zones,

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** Landsat is an acronym for Land Satellite. Data from this satellite is available as four spectral bands of information in either a photographic or computer compatible tape format.

*** Aerial photographic subsamples at nominal scales of 1:1200 to 1:6000 have been utilized. Also both 35mm and 9x9 inch formats have been used.

**** Ground samples are selected as subsamples of the aerial photographs.

digital terrain data (elevation, slope, aspect), access corridors, distance to water, production information, and the like. The resulting digital data base can then be utilized to generate resource management opportunity maps by digitally combining or overlaying any combination of these management parameters.

A similar multiphase sampling concept has also been applied in the program to determine production information for forests by stand, woodlands by allotment, and palatable forage by pasture and allotment. In all cases the analysis approach utilized in the program uses Landsat only as a stratification base and relies on the large scale photographs and ground samples for the required detailed information.

3.0 Wildland Vegetation Resource Inventory Program and SVIM

As previously mentioned the Wildland Vegetation Resource Inventory Program is oriented toward broad regional type information and was specifically directed to URA. The program does not compete with or replace any part of SVIM. The Steering Committee has directed DSC (D-440, D-460, D-234) to evaluate the potential utility of this technology within SVIM. This effort is scheduled to be initiated in FY80. The first report on the results of the evaluation will be presented to the Steering Committe in late September or early October, 1980.

4.0 Technology Applications

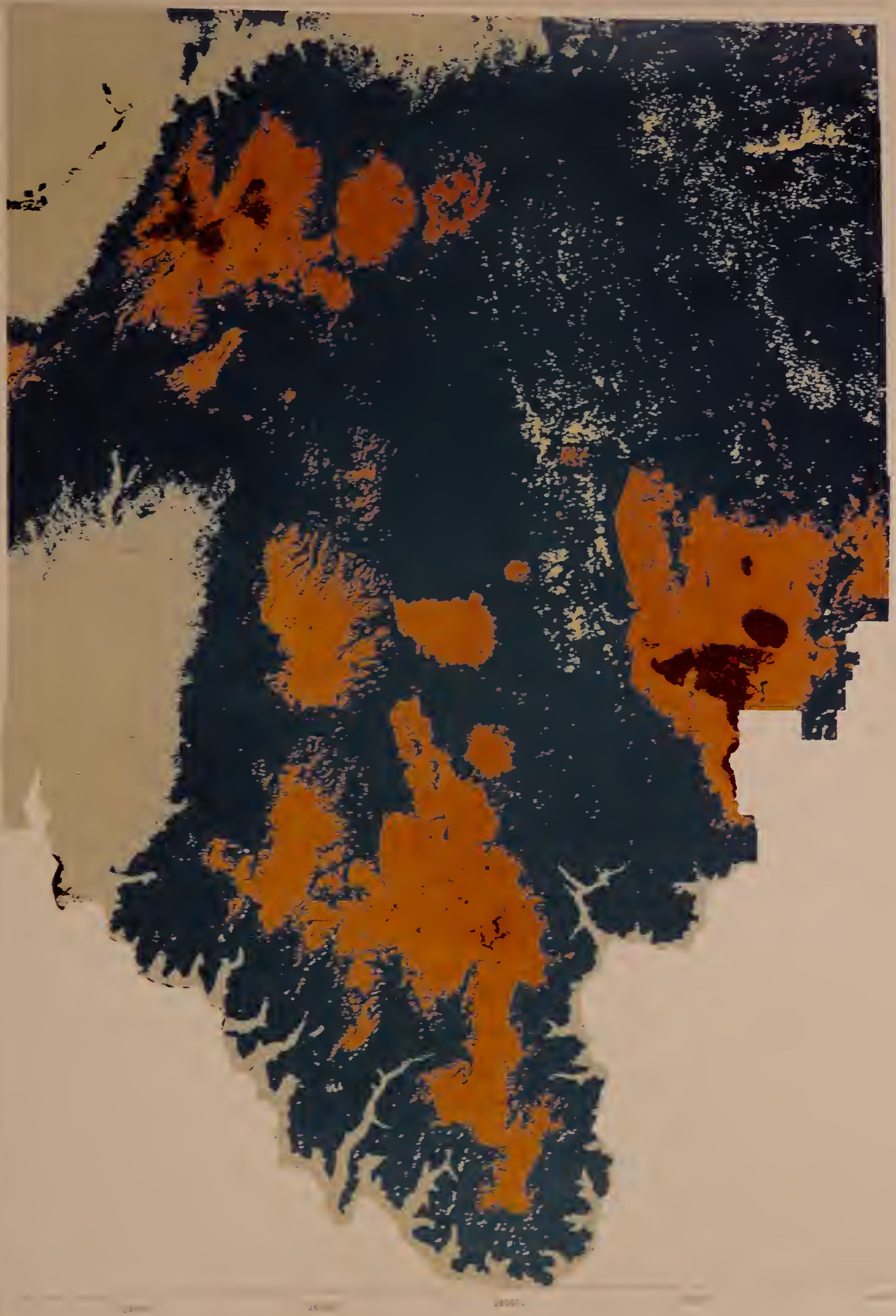
This section defines those aspects of the Wildland Vegetation Resource Inventory Program which can be immediately utilized at field office discretion.

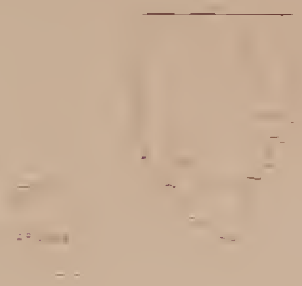
4.1 Land Cover Maps

A variety of cartographic quality map products displaying land cover information can be generated from the digital data base. Very general Level I (biome) cover types can be mapped with accuracies in excess of 90%. Level II (formation) cover types can be mapped with accuracies in the 70% to 85% range. More detailed Level II (association) maps can also be delineated with an attendent reduction in accuracy to 45% to 60%. Mixed Level II and III maps can also be generated using this process. Although any mapping minimum from 1 acre up can be displayed, it is generally recommended that a 10 acre mapping aggregation be considered the smallest unit. Figure 4-1 is an example of a land cover map at a 1:250000 scale. Printed on the reverse side of this map is additional information that is available as part of the data base. Acreage summaries and cover type descriptions are examples of the additional information available in the data base. Figure 4-2 illustrates the additional information available for this particular area.

LANDSAT VEGETATION CLASSIFICATION

ARIZONA STRIP DISTRICT, ARIZONA
SOURCE DATA AUGUST 26, 1977
SCENE I.D. 2947-17074
MAPPING UNIT 10 ACRES (4 HECTARES)





"SUMMARY CLASS"		VEGETATION DESCRIPTION
⬛	1	CROPLAND AND PASTURE (1.1)
🟫	2	CONIFEROUS FOREST (2.1)
🟧	3	EVERGREEN WOODLAND (3.1)
🟫	4	DECIDUOUS WOODLAND (3.2)
⬜	5	MOHAVE DESERT SHRUB (4.1)
🟦	6	GREAT BASIN DESERT SHRUB (4.2)
⬛	7	MOUNTAIN SHRUB (4.3)
🟨	8	PLAINS GRASSLAND (5.1)

NUMBERS IN PARENTHESIS REFERENCE HIERARCHICAL NUMBER SYSTEM OF VEGETATION CLASSIFICATION FRAMEWORK

WILDLAND VEGETATION RESOURCE INVENTORY SYSTEM
NASA BLM ASVT PHASE II
ANALYSIS COMPLETED MAY 1979
BY U.S. GEOLOGICAL SURVEY, EROS DATA CENTER

Hierarchical Vegetation Classification Framework for the Arizona Strip District Test Site

Level I (Biome)	Level II (Formation)	Level III (Association)	Level IV (Community)
1 Agricultural land	1 Cropland and pasture	1 Pasture	
		2 Cropland	
2 Forest	1 Coniferous forest	1 Ponderosa pine forest	1 Ponderosa pine-sagebrush
			2 Ponderosa pine-pinyon-juniper
			3 Ponderosa pine-mountain shrub
			4 Ponderosa pine
		2 Mixed conifer forest	1 Ponderosa pine-fir
3 Woodland	1 Evergreen woodland	1 Pinyon-juniper woodland	1 Juniper
			2 Juniper-shrub
			3 Juniper-pinyon
			4 Juniper-pinyon-shrub
			5 Pinyon
			6 Pinyon-shrub
			7 Pinyon-juniper
			8 Pinyon-juniper-shrub
	2 Deciduous woodland	1 Upland woodland	1 Gambel oak
			2 Gambel oak-locust
			3 Aspen
		2 Riparian woodland	1 Cottonwood
			2 Cottonwood-shrub
			3 Salt cedar
			4 Salt cedar-shrub
4 Shrubland	1 Mohave desert shrub	1 Riparian desert shrub	1 Mesquite-acacia
			2 Tall rabbitbrush
		2 Upland desert shrub	1 Creosote
			2 Bursage
			3 Yucca
			4 Mixed desert shrub
	2 Great Basin desert shrub	1 Great Basin sagebrush	1 Big sagebrush
			2 Big sagebrush-perennial grass
			3 Big sagebrush-mixed shrub
			4 Big sagebrush-tree
		2 Saltshrub	1 Shadscale
			2 Fourwing saltbush
		3 Blackbrush	1 Blackbrush
			2 Blackbrush-tree
			3 Blackbrush-other desert shrub
		4 Other tall shrub	1 Cliffrose
			2 Winterfat
			3 Tall rabbitbrush
		5 Half shrub	1 Snakeweed
			2 Little rabbitbrush
	3 Mountain shrub	1 Mountain chaparral	1 Manzanita
			2 Mixed chaparral
		2 Oakbrush	1 Gambel oak
			2 Turbinella oak
			3 Mixed oak
		3 Other mountain shrub	1 Serviceberry-ceanothus
			2 Mixed mountain shrub
5 Grassland	1 Plains grassland	1 Perennial grassland	1 Grama-galleta steppe
			2 Grama-galleta-shrub steppe
			3 Needlegrass
			4 Western wheatgrass
			5 Indian rice grass
			6 Mixed cool season grasses
			7 Mixed wheatgrass
			8 Mixed wheatgrass-shrub
			9 Annual rye
			10 Squirreltail-shrub
			11 Squirreltail
		2 Annual grassland and forbs	1 Cheatgrass
			2 Cheatgrass-shrub
			3 Russian thistle
			4 Mustard
6 Barren land	1 Natural features	1 Exposed surface rock	1 Rock
			2 Gravel
			3 Gravelly soil
		2 Other exposed rock	
		3 Bare soil	
	2 Cultural features	1 Roads - cuts - fills	
		2 Mines	
		3 Gravel pits	
		4 Dry stock ponds	
7 Water	1 Water	1 Water	1 Water

Figure 4-2

Landsat Scene: 2947-17074 (Path 41, Row 35)
Date: 26 August 1976 (Entire Project Area)

This scene contains 83 computer classes that have been aggregated into 8 summary classes based on land cover. Shown for each summary class are:

1. The vegetation cover type name according to the hierarchical vegetation classification framework developed for the Arizona Test Site.
2. The number of acres, hectares, and % of total area represented by the summary class.
3. The elevation range for the summary class.
4. The number of acres and % of summary class within each of 5 slope classes and 6 aspect classes.
5. The cover type description indicating the percent of the total number of photo plots in that class that were interpreted as that cover type.

Summary Class: 1 **Computer Classes:** 70, 77
Cover Type: Cropland and pasture
Area: Acres 3,293
Hectares 1,333
% Project Area in Class <1

ELEVATION: 1,000 ft. - 2,000 ft.
(305 m - 610 m)

SLOPE:

Slope	Area (Acres)	% of Class
<5%	2,473	75
6 - 10%	133	4
11 - 20%	221	7
21 - 50%	294	9
>50%	172	5

ASPECT:

Aspect	Area (Acres)	% of Class	Aspect	Area (Acres)	% of Class
W	387	11	E	582	16
NW	472	14	SE	208	6
N	242	7	S	676	21
NE	68	2	SW	676	21

COVER TYPE DESCRIPTION BASED ON PHOTO DATA
Total Photo Plots 99

Cropland and pasture	Deciduous woodland	Mohave desert shrub
Cropland and pasture 19%	Salt cedar 44% Salt cedar-shrub 36%	Mixed desert shrub 1%
Total 19%	80%	1%

Summary Class: 2 **Computer Classes:** 61, 62, 76
Cover Type: Coniferous forest
Area: Acres 22,420
Hectares 9,073
% Project Area in Class <1

ELEVATION: 5,800 ft. - 6,200 ft.
(1,768 m - 2,499 m)

SLOPE:

Slope	Area (Acres)	% of Class
<5%	5,614	26
6 - 10%	3,799	17
11 - 20%	4,984	22
21 - 50%	6,729	30
>50%	1,094	5

ASPECT:

Aspect	Area (Acres)	% of Class	Aspect	Area (Acres)	% of Class
W	1,803	8	E	2,420	11
NW	2,909	13	SE	2,013	9
N	4,398	20	S	2,792	12
NE	3,522	16	SW	2,563	11

COVER TYPE DESCRIPTION BASED ON PHOTO DATA
Total Photo Plots 267

Coniferous forest	Evergreen woodland	Deciduous woodland	Great Basin desert shrub	Mountain shrub
Ponderosa pine-sagebrush 2% Ponderosa pine-pinyon-juniper 16% Ponderosa pine-mountain shrub 33% Ponderosa pine 13%	Pinyon-juniper <1% Pinyon-juniper-shrub 10%	Gambel oak 3% Aspen 1%	Big sagebrush-mixed shrub <1% Big sagebrush-tree <1%	Gambel oak 15% Mixed oak 3% Mixed mountain shrub <1%
Total 68%	11%	4%	1%	16%

Summary Class: 3 **Computer Classes:** 1, 5, 13, 17, 19, 23, 25, 27, 26, 35, 36, 39, 42, 46, 48, 49, 51, 64, 66,67, 79
Cover Type: Evergreen woodland
Area: Acres 423,681
Hectares 171,464
% Project Area in Class 17

ELEVATION: 2,400 ft. - 7,800 ft.
(732 m - 2,377 m)

SLOPE:

Slope	Area (Acres)	% of Class
<5%	206,350	49
6 - 10%	65,528	15
11 - 20%	65,639	18
21 - 50%	71,381	17
>50%	14,783	3

ASPECT:

Aspect	Area (Acres)	% of Class	Aspect	Area (Acres)	% of Class
W	38,226	9	E	76,053	18
NW	37,261	9	SE	40,034	9
N	61,032	14	S	48,910	12
NE	72,261	17	SW	49,904	12

COVER TYPE DESCRIPTION BASED ON PHOTO DATA
Total Photo Plots 1,167

Coniferous forest	Evergreen woodland	Great Basin desert shrub	Mountain shrub
Ponderosa pine-sagebrush <1% Ponderosa pine-pinyon-juniper 2% Ponderosa pine <1%	Pinyon-juniper 3% Pinyon-juniper shrub 76%	Big sagebrush-perennial grass 1% Big sagebrush-mixed shrub 1% Big sagebrush-tree 2% Blackbrush <1% Blackbrush-tree 5% Blackbrush-other desert shrub 2% Snakeweed 1% Little rabbit-brush <1%	Manzanita <1% Mixed chaparral 5% Gambel oak <1% Turbinella oak <1% Mixed oak 1%
Total 2%	79%	12%	7%

Summary Class: 4 **Computer Classes:** 65, 73, 80
Cover Type: Deciduous woodland
Area: Acres 2,016
Hectares 617
% Project Area in Class <1

ELEVATION: 1,000 ft. - 3,200 ft. and 6,400 ft. - 6,800 ft.
(305 m - 974 m and 1,951 m - 2,073 m)

SLOPE:

Slope	Area (Acres)	% of Class
<5%	1,201	60
6 - 10%	83	4
11 - 20%	103	5
21 - 50%	321	16
>50%	310	15

ASPECT:

Aspect	Area (Acres)	% of Class	Aspect	Area (Acres)	% of Class
W	266	13	E	358	16
NW	322	16	SE	156	6
N	190	9	S	268	13
NE	141	7	SW	317	16

COVER TYPE DESCRIPTION BASED ON PHOTO DATA
Total Photo Plots 30

Evergreen woodland	Deciduous woodland	Mohave desert shrub	Mountain shrub
Pinyon-juniper-shrub 10%	Salt cedar 50% Salt cedar-shrub 20%	Mixed desert shrub 13%	Mixed chaparral 7%
Total 10%	70%	13%	7%

Summary Class: 5 **Computer Classes:** 3, 6, 9, 16, 29, 31, 32, 43, 44, 59, 71, 74, 61
Cover Type: Mohave desert shrub
Area: Acres 408,031
Hectares 165,131
% Project Area in Class 17

ELEVATION: 800 ft. - 3,400 ft.
(244 m - 1,036 m)

SLOPE:

Slope	Area (Acres)	% of Class
<5%	219,292	54
6 - 10%	61,302	15
11 - 20%	45,023	11
21 - 50%	45,240	11
>50%	37,174	9

ASPECT:

Aspect	Area (Acres)	% of Class	Aspect	Area (Acres)	% of Class
W	59,080	14	E	52,151	13
NW	51,482	13	SE	47,472	12
N	42,465	10	S	65,835	16
NE	28,631	7	SW	60,915	15

COVER TYPE DESCRIPTION BASED ON PHOTO DATA
Total Photo Plots 1,570

Deciduous woodland	Mohave desert shrub	Great Basin desert shrub	Natural features	Water
Salt cedar <1% Salt cedar-shrub 2%	Mesquite-acacia <1% Tall rabbitbrush <1% Creosote 42% Bursage 21% Mixed desert shrub 31%	Blackbrush <1% Blackbrush-other desert shrub <1% Snakeweed <1%	Natural features <1%	Water <1%
Total 2%	96%	1%	<1%	<1%

Summary Class: 6 **Computer Classes:** 2, 4, 7, 8, 10, 11, 12, 14, 15, 16, 20, 21, 24, 26, 30, 33, 37, 41, 45, 47, 50, 52, 53, 57, 58, 60, 68, 69, 72, 82
Cover Type: Great Basin desert shrub
Area: Acres 1,508,669
Hectares 610,559
% Project Area in Class 61

ELEVATION: 2,600 ft. - 7,000 ft.
(792 m - 2,134 m)

SLOPE:

Slope	Area (Acres)	% of Class
<5%	848,752	56
6 - 10%	172,365	11
11 - 20%	176,821	12
21 - 50%	221,959	15
>50%	66,772	6

ASPECT:

Aspect	Area (Acres)	% of Class	Aspect	Area (Acres)	% of Class
W	138,281	9	E	270,809	16
NW	144,465	10	SE	124,246	6
N	239,534	16	S	150,705	10
NE	260,013	17	SW	180,596	12

COVER TYPE DESCRIPTION BASED ON PHOTO DATA
Total Photo Plots 4,105

Evergreen woodland	Mohave desert shrub	Great Basin desert shrub	Mountain shrub	Plains grassland	Natural features
Pinyon-juniper <1% Pinyon-juniper-shrub 21%	Mesquite-acacia <1% Creosote 2% Bursage 1% Mixed desert shrub 2%	Big sagebrush 2% Big sagebrush-perennial grass 10% Big sagebrush-mixed shrub 15% Big sagebrush-tree 9% Shadscale <1% Fourwing saltbush <1% Blackbrush 4% Blackbrush-tree 4% Blackbrush-other desert shrub 12% Cliffrose <1% Tall rabbitbrush 1% Snakeweed 9%	Mixed chaparral 2% Turbinella oak 1% Mixed oak <1% Mixed mountain shrub <1%	Grama-galleta steppe <1% Grama-galleta-shrub steppe <1% Cheatgrass-shrub <1%	Natural features <1%
Total 21%	5%	68%	4%	1%	<1%

Summary Class: 7 **Computer Classes:** 22, 38, 55, 63, 75, 76, 83
Cover Type: Mountain shrub
Area: Acres 20,583
Hectares 6,330
% Project Area in Class 1

ELEVATION: 3,400 ft. - 8,200 ft.
(1,036 m - 2,499 m)

SLOPE:

Slope	Area (Acres)	% of Class
<5%	5,913	29
6 - 10%	2,144	10
11 - 20%	3,062	15
21 - 50%	6,858	33
>50%	2,606	13

ASPECT:

Aspect	Area (Acres)	% of Class	Aspect	Area (Acres)	% of Class
W	2,606	13	E	2,779	13
NW	2,846	14	SE	2,098	10
N	2,862	14	S	2,071	10
NE	2,902	14	SW	2,419	12

COVER TYPE DESCRIPTION BASED ON PHOTO DATA
Total Photo Plots 154

Coniferous forest	Evergreen woodland	Deciduous woodland	Great Basin desert shrub	Mountain shrub
Ponderosa pine-sagebrush 3% Ponderosa pine-mountain shrub 10% Ponderosa pine 1%	Pinyon-juniper-shrub 16%	Gambel oak 1%	Big sagebrush-perennial grass 1% Big sagebrush-mixed shrub 2% Big sagebrush-tree 1% Blackbrush 1% Blackbrush-other desert shrub <1%	Mixed chaparral 40% Gambel oak 17% Turbinella oak 1% Mixed oak 3% Mixed mountain shrub 3%
Total 14%	16%	1%	5%	64%

Summary Class: 6 **Computer Classes:** 34, 40, 54, 58
Cover Type: Plains grassland
Area: Acres 82,651
Hectares 33,449
% Project Area in Class 3

ELEVATION: 4,000 ft. - 5,600 ft.
(1,219 m - 1,707 m)

SLOPE:

Slope	Area (Acres)	% of Class
<5%	66,457	80
6 - 10%	5,657	7
11 - 20%	4,282	5
21 - 50%	4,819	6
>50%	1,436	2

ASPECT:

Aspect	Area (Acres)	% of Class	Aspect	Area (Acres)	% of Class
W	5,687	7	E	15,461	19
NW	7,081	6	SE	4,671	6
N	17,468	21	S	7,915	10
NE	16,322	20	SW	7,646	9

COVER TYPE DESCRIPTION BASED ON PHOTO DATA
Total Photo Plots 211

Evergreen woodland	Great Basin desert shrub	Mountain shrub	Plains grassland	Natural features
Pinyon-juniper 6%	Big sagebrush-perennial grass 16% Big sagebrush-mixed shrub 10% Big sagebrush-tree 1% Fourwing saltbush 4% Blackbrush 2% Blackbrush-tree 1% Blackbrush-other desert shrub 6% Cliffrose 1% Snakeweed 34% Little rabbit-brush 5%	Turbinella oak 10%	Grama-galleta-shrub steppe 1% Cheatgrass-shrub 1% Mustard 1%	Natural features 1%
Total 6%	80%	10%	3%	1%

4.2 Management Opportunity Overlays

A variety of cartographic quality map overlays can be produced from the data base. Numerous combinations of resource and environmental information can be made through management parameters to generate useful output products. Figure 4-3 is an example of such an overlay displaying Potential Desert Big Horn Sheep Habitat at a scale of 1:250000. Figure 4-4 illustrates the same theme at a scale of 1:126720. Figure 4-5 shows a portion of that theme at a scale of 1:63360 and Figure 4-6 displays the latter information at a scale of 1:24000. Table 4-1 lists management opportunity overlays developed thus far in the program for the Arizona Strip District. Table 4-2 lists overlays currently being produced for the Arizona Strip District. It is to be stressed that this type of product can only be produced after the previously discussed data base (Landsat classification plus ancillary data) has been generated.

4.3 Tabular Listings of Production

Multiphase sampling techniques can be applied to obtain production data for forests, woodlands, and range. Areas are stratified based upon Landsat and related information (e.g., elevation, slope, aspect); production related parameters (e.g., crown diameter, density, tree height) are interpreted from aerial photographs; and

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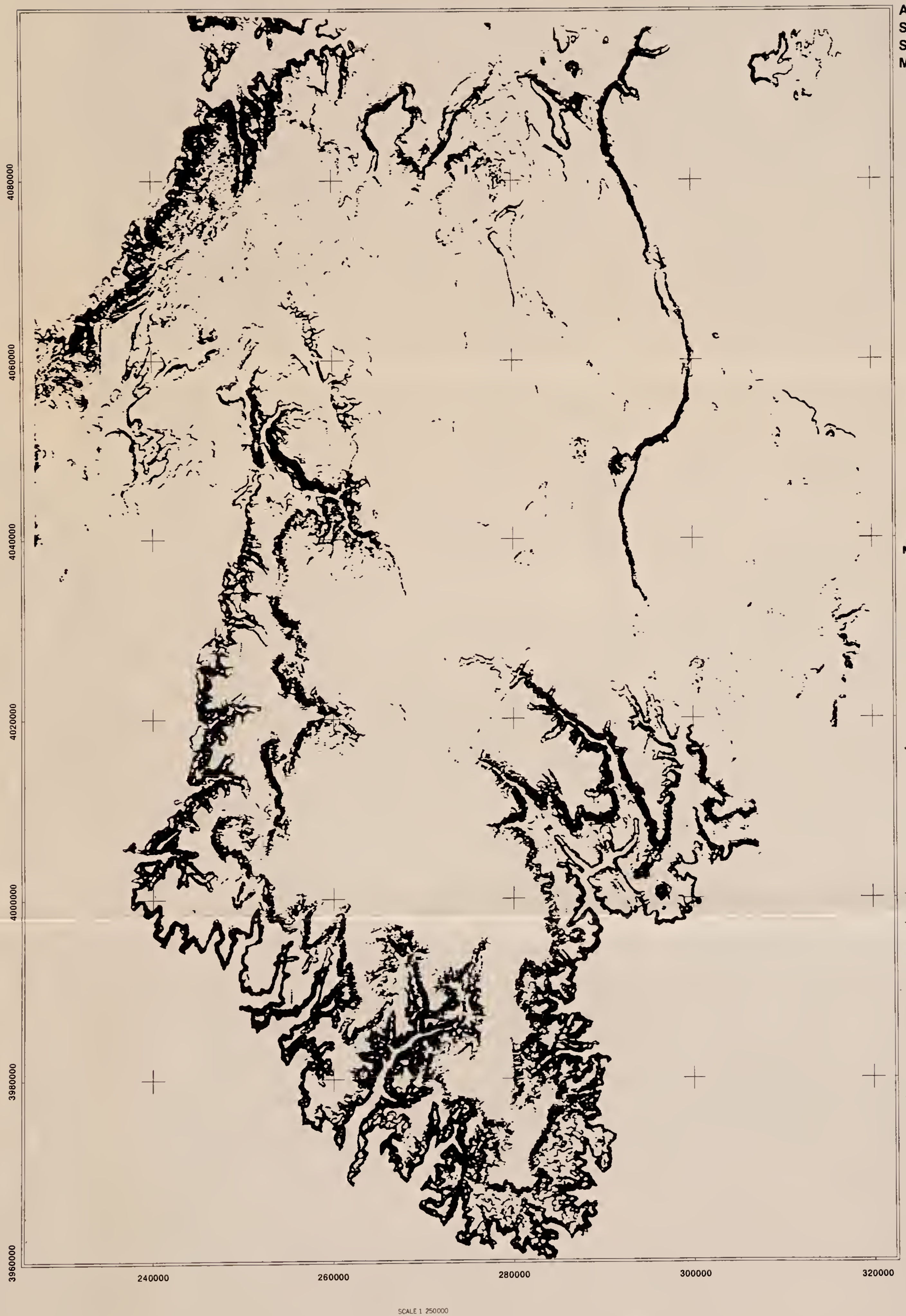
many?

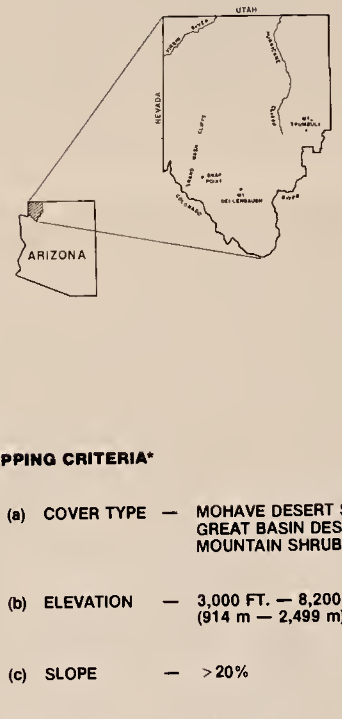
Figure 4-3

POTENTIAL DESERT BIGHORN SHEEP HABITAT



GRID NUMBERS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 12

ARIZONA STRIP DISTRICT, ARIZONA
SOURCE DATA AUGUST 26, 1977
SCENE I.D. 2947-17074
MAPPING UNIT 10 ACRES (4 HECTARES)



MAPPING CRITERIA*

(a) COVER TYPE — MOHAVE DESERT SHRUB
GREAT BASIN DESERT SHRUB
MOUNTAIN SHRUB

(b) ELEVATION — 3,000 FT. — 8,200 FT.
(914 m — 2,499 m)

(c) SLOPE — >20%

(d) ASPECT — VARIABLE

*Vegetation data derived from Landsat vegetation classification of scene I.D. 2947 - 17074 acquired August 26, 1977. Elevation, slope and aspect were derived from NCIC digital terrain data.

Area mapped as potential desert bighorn sheep habitat: 336,622 acres
(136,231 hectares)

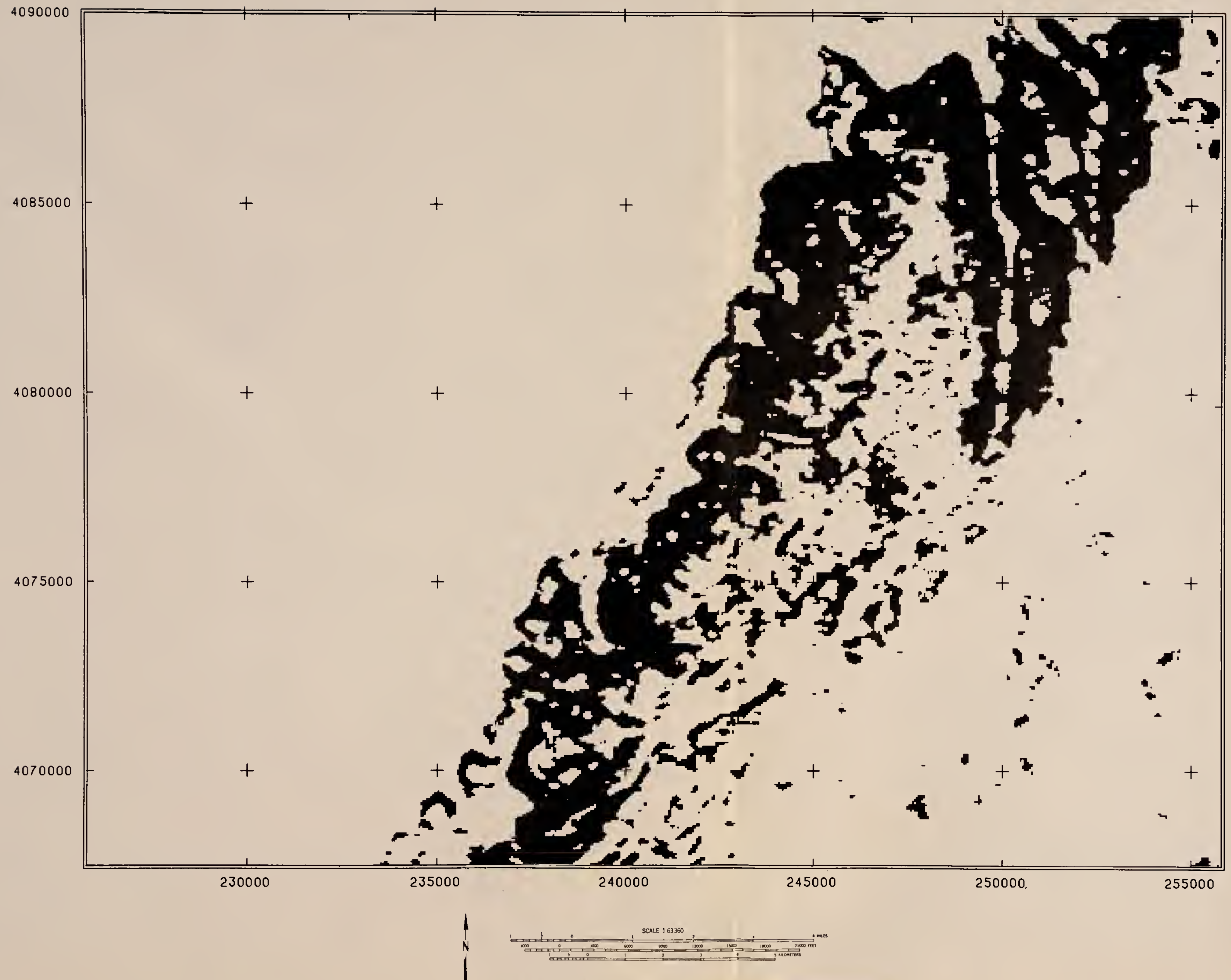
COVER TYPE DESCRIPTION BASED ON PHOTO DATA

Total Photo Plots: 1,328

Coniferous forest	Evergreen woodland	Mohave desert shrub	Great Basin desert shrub	Mountain shrub
Ponderosa pine-sagebrush <1% Ponderosa-pine-juniper-pinyon <1% Ponderosa-pine <1%	Juniper-pinyon 1% Juniper-pinyon-shrub 21%	Creosote 4% Bursage 2% Mixed desert shrub 4%	Big sagebrush-perennial grass 1% Big sagebrush-mixed shrub 8% Big sagebrush-tree 3% Blackbrush 7% Blackbrush-tree 10% Blackbrush - other desert shrub 18% Tall rabbit-brush 1% Snakeweed 5% Little rabbit-brush 2%	Mixed chaparral 11% Gambel oak <1% Turbinella oak <1% Mixed oak 2%
Total 1%	22%	10%	53%	14%

WILDLAND VEGETATION RESOURCE INVENTORY SYSTEM
NASA/BLM ASVT PHASE II
ANALYSIS COMPLETED MAY, 1979
BY U.S. GEOLOGICAL SURVEY, EROS DATA CENTER

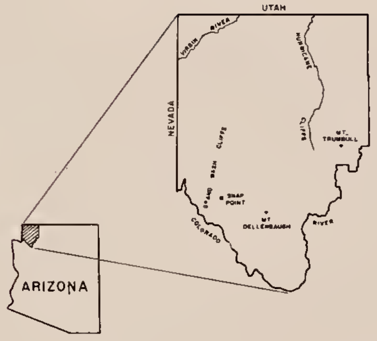
POTENTIAL DESERT BIGHORN SHEEP HABITAT



GRID NUMBERS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 12

Figure 4-4

ARIZONA STRIP DISTRICT, ARIZONA
SOURCE DATA AUGUST 26, 1977
SCENE I.D. 2947-17074
MAPPING UNIT 10 ACRES (4 HECTARES)



MAPPING CRITERIA*

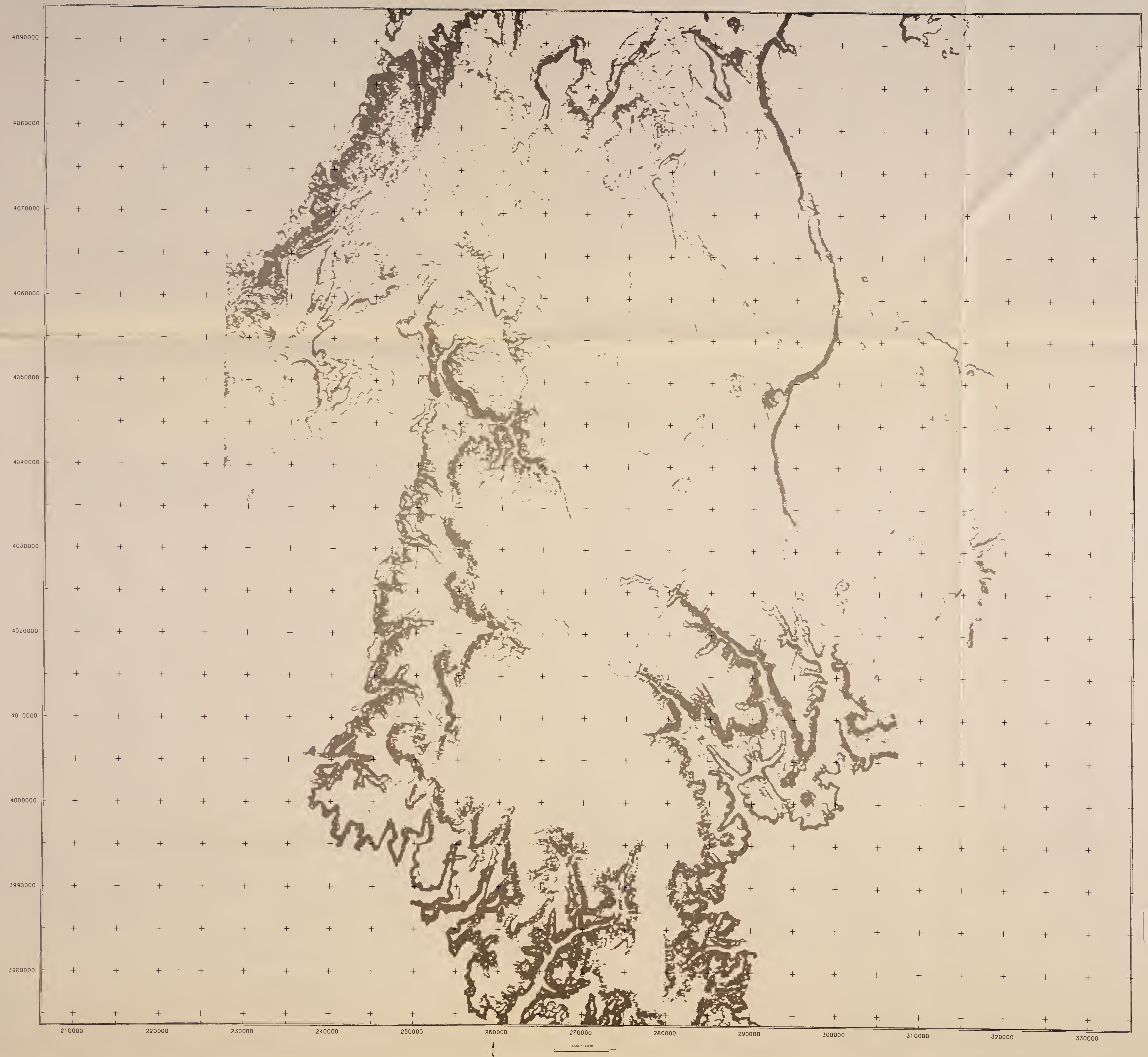
(a)	COVER TYPE	—	MOHAVE DESERT SHRUB GREAT BASIN DESERT SHRUB MOUNTAIN SHRUB
(b)	ELEVATION	—	3,000 FT. — 8,200 FT. (914 m — 2,499 m)
(c)	SLOPE	—	>20%
(d)	ASPECT	—	VARIABLE

*Vegetation data derived from Landsat vegetation classification of scene I.D. 2947 - 17074 acquired August 26, 1977. Elevation, slope and aspect were derived from NCIC digital terrain data.

Area mapped as potential desert bighorn sheep habitat: ▬ acres
(▬ hectares)

WILDLAND VEGETATION RESOURCE INVENTORY SYSTEM
NASA/BLM' ASVT PHASE II
ANALYSIS COMPLETED MAY, 1979
BY U.S. GEOLOGICAL SURVEY, EROS DATA CENTER

POTENTIAL DESERT BIGHORN SHEEP HABITAT



GRID NUMBERS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 12

ARIZONA STRIP DISTRICT, ARIZONA
SOURCE DATA AUGUST 26, 1977
SCENE I.D. 2947-17074
MAPPING UNIT 10 ACRES (4 HECTARES)

MAPPING CRITERIA*

(a) COVER TYPE — MOHAVE DESERT SHRUB
GREAT BASIN DESERT SHRUB
MOUNTAIN SHRUB

(b) ELEVATION — 3,000 FT. — 8,200 FT.
(914 m — 2,499 m)

(c) SLOPE — >20%

(d) ASPECT — VARIABLE

*Vegetation data derived from Landsat vegetation classification of scene I.D. 2947 - 17074 acquired August 26, 1977. Elevation, slope and aspect were derived from NCIC digital terrain data.

Area mapped as potential desert bighorn sheep habitat [redacted] acres
([redacted] hectares)

COVER TYPE DESCRIPTION BASED ON PHOTO DATA

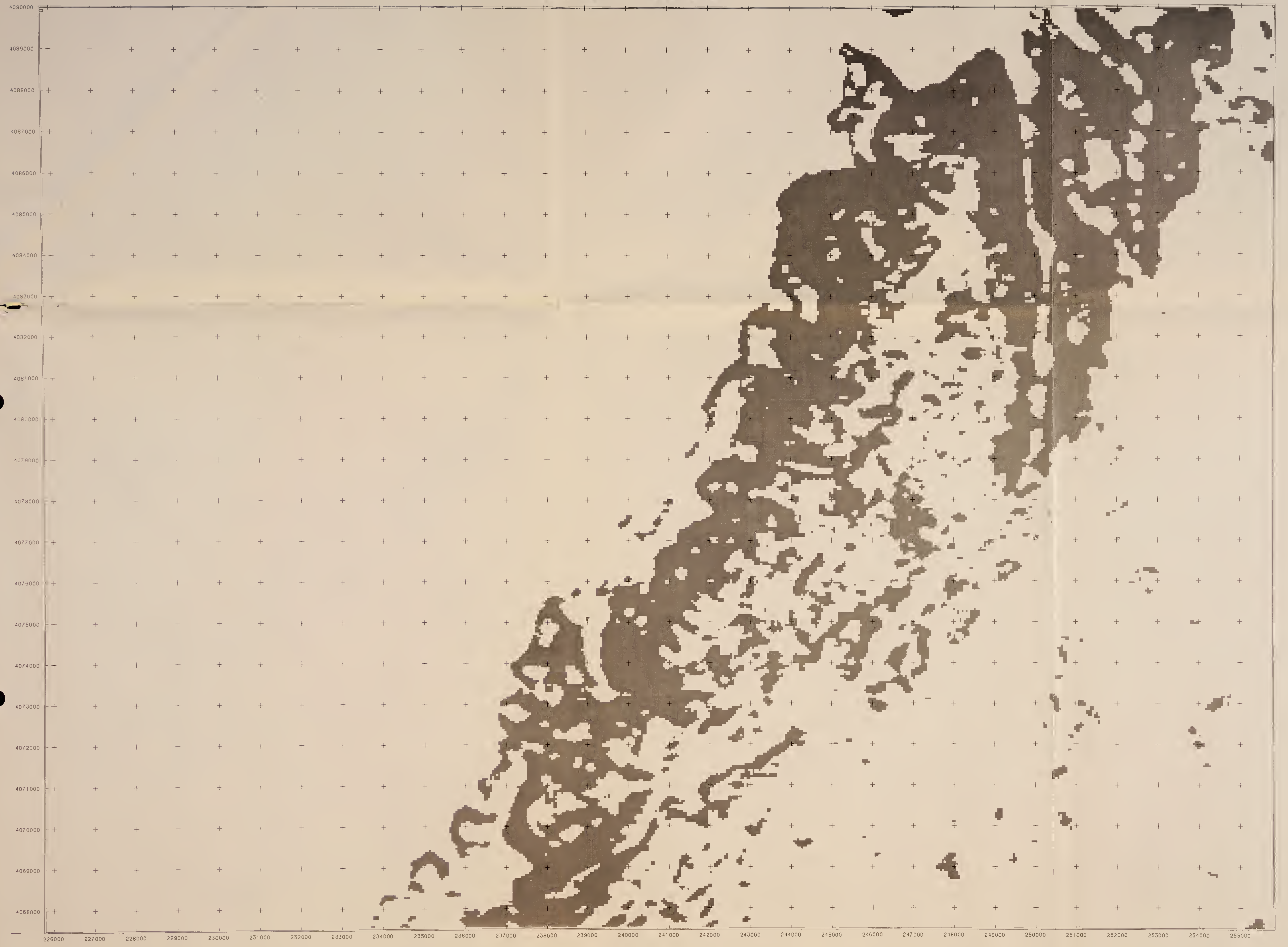
Total Photo Plots. 1,326

Coniferous forest	Evergreen woodland	Mohave desert shrub	Great Basin desert shrub	Mountain shrub
Ponderosa pine-sagebrush <1% Ponderosa-pine-juniper-pinyon <1% Ponderosa-pine <1%	Juniper-pinyon 1% Juniper-pinyon-shrub 21%	Creosote 4% Bursage 2% Mixed desert shrub 4%	Big sagebrush-perenniel grass 1% Big segebrush-mixed shrub 8% Big sagebrush-tree 3% Bleckbrush 7% Blackbrush-tree 10% Blackbrush - other desert shrub 16% Tall rabbit-brush 1% Snakeweed 5% Little rabbit-brush 2%	Mixed cheparral 11% Gambel oak <1% Turbinella oak <1% Mixed oak 2%
Totel 1%	22%	10%	53%	14%

Figure 4-5

WILDLAND VEGETATION RESOURCE INVENTORY SYSTEM
NASA/BLM ASVT PHASE II
ANALYSIS COMPLETED MAY, 1979
BY U.S. GEOLOGICAL SURVEY, EROS DATA CENTER

POTENTIAL DESERT BIGHORN SHEEP HABITAT



ARIZONA STRIP DISTRICT, ARIZONA
SOURCE DATA AUGUST 26 1977
SCENE I.D. 2947-17074
MAPPING UNIT 10 ACRES (4 HECTARES

MAPPING CRITERIA*

(a) COVER TYPE — MOHAVE DESERT SHRUB
GREAT BASIN DESERT SHRUB
MOUNTAIN SHRUB

(b) ELEVATION — 3,000 FT. — 8,200 FT.
(914 m — 2,499 m)

(c) SLOPE — 20%

(d) ASPECT — VARIABLE

*Vegetation data derived from Landsat vegetation classification of scene I.D. 2 17074 acquired August 26, 1977. Elevation, slope and aspect were derived from digital terrain data

Area mapped as potential desert bighorn sheep habitat 27629 acres
(11181 hectares)

WILDLAND VEGETATION RESOURCE INVENTORY SYSTEM
NASA/BLM ASVT PHASE II
ANALYSIS COMPLETED MAY, 1979
BY U.S. GEOLOGICAL SURVEY, EROS DATA CENTER

N

SCALE 1 24000

GRID NUMBERS INDICATE THE UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 12

Figure 4-6

Table 4-1

Management Opportunity Overlays Available

(Arizona Strip District)

Management Opportunity Overlay	Scale	Management Parameters
Mule Deer Summer Range	1:250,000	1. Coniferous Forest, Evergreen Woodland, Great Basin Desert Shrub 2. Elevation 5,500 ft. - 8,200 ft. 3. Aspect and Slope variable
Mule Deer Winter Range	1:250,000	1. Evergreen Woodland, Great Basin Desert Shrub, Mountain Shrub 2. Elevation 3,500 ft. - 5,500 ft. 3. Aspect is Southeast, South, Southwest 4. Slope 10% - 50%
Antelope Habitat	1:250,000	1. Great Basin Desert Shrub, Plains Grassland 2. Elevation 4,000 ft. - 6,000 ft. 3. Aspect is variable 4. Slope is less than 20%
Desert Big Horn Sheep Habitat	1:250,000, 1:126,720, 1:63,360, 1:24,000	1. Mohave Desert Shrub, Great Basin Desert Shrub, Mountain Shrub:, 2. Elevation 3,000 ft. - 8,200 ft. 3. Aspect is variable 4. Slope is less than 20%
Grazing Suitability by Slope	1:250,000	1. Great Basin Desert Shrub 2. Aspect and elevation are variable 3. Slope classes as follows: 0-10%, 11-20%, 21-50%, 51-100%, > 100%
Pinyon-Juniper Chaining Areas	1:250,000	1. Evergreen Woodland 2. Elevation 5,000 ft. - 7,800 ft. 3. Aspect is variable 4. Slope is less than 10%
Sagebrush Treatment Areas	1:250,000	1. Great Basin Desert Shrub 2. Elevation 5,000 ft. - 7,000 ft. 3. Aspect is variable 4. Slope is less than 10%

Table 4-2

Management Opportunity Overlays in Preparation

(Arizona Strip District)

Management Opportunity Overlay	Scale	Management Parameters
Rangeland Suitability	1:126,720	1. Current production of usable forage is greater than 25 pounds per acre 2. Distance to water is less than 4 miles 3. Aspect and elevation are variable 4. Slope is less than 51%
Potential Rangeland Suitability	1:126,720	1. Current production of usable forage is greater than 25 pounds per acre 2. Distance to water is greater than 4 miles 3. Aspect and elevation are variable 4. Slope is less than 51%
Sagebrush Treatment Areas	1:126,720	1. Great Basin Sagebrush Vegetation Community 2. Area is located on Tours Series Soil 3. Aspect and elevation are variable 4. Slope is less than 15%
Fire Flash Fuel Areas	1:126,720	1. Low desert as defined by ISO-precipitation line 2. Annual grass and forbs cover 30% or greater of the ground area 3. Elevation and slope are variable 4. Aspect is Southwest, South, Southeast

measurements (e.g., clipping and weighing) are made on the ground. No production related calculations are made from Landsat.

4.3.1 Forests

Table 4-3 lists production data for forests for selected areas within the Arizona Strip District. These data are also incorporated into the digital data base. The data are tabulated by stand.

4.3.2 Woodlands

Table 4-4 lists production data for woodlands for selected areas within the Arizona Strip District. The data are also incorporated into the digital base. The data are tabulated by allotment.

4.3.3 Range

Table 4-5 lists current production for range for selected allotments within the Arizona Strip District. Table 4-6 lists current production for selected pastures within the Arizona Strip District. These data are representative of palatable forage only and are based upon Proper Use Factors (PUF) supplied by the District. These data are also incorporated into the digital data base.

Table 4-3

Production for Forests by Stand

(Arizona Strip District)

Area B (Stand)	Area (Acres)	Total Volume Board Feet	Average Volume Board Feet/Acre
20	746	214,110	287
21	9210	2,874,646	312
22	4460	2,309,695	518

Table 4-4

Production Data for Woodlands by Allotment

(Arizona Strip District)

Allotment Number	Area (acres)	Pinyon		Juniper	
		Total Ft^3	Ft^3/acre	Total Ft^3	Ft^3/acre
4823	12,186	341,194	28	2,215,250	181
4839	14,944	478,220	32	2,770,360	187
4841	32,979	857,445	26	4,831,310	148

Table 4-5

Range Production Data by Allotment

(Current Production 7-1-79/9-30-79)

Allotment (Name)	(Number)	Total Area Acres	Total Production Lbs.	Avg Production Lbs/Acre
Jump Canyon	4801	28,121	427,073	15.2
White Rock Soapstone	4804	18,905	293,005	15.6
Mainstreet	4805	110,157	1,822,700	16.6
Wolf Hole Canyon	4811	25,840	300,553	11.6
Wolf Hole	4823	13,464	212,835	15.8
Parashaunt	4829	76,493	1,098,520	14.4
Lower Hurricane	4837	46,414	614,122	13.2
Wolf Hole Mountain	4839	14,899	226,291	15.2
Blackrock	4841	37,760	392,950	10.4
Black Willow Tassi Spring	4851	102,384	412,880	4.0
Toker Tank	4861	12,846	228,720	17.8

Notes:

1. Production is shown for palatable forage.
2. PUF's and species list of palatable types provided by District.
3. Production data calculated from ground data samples.

Table 4-6

Range Production Data by Pasture

(Arizona Strip District)

Mainstreet Allotment Pasture	Total Volume Lbs	Average Volume Lbs/Acre
Cecil	78,623.75	19.84
Round Pond	73,300.31	22.12
Square Pond	143,179.63	19.52
Anthony's Higley	200,584.75	19.97
Calving	18,163.00	20.18
Temple Trail	97,761.06	18.17
Salaratus	82,236.88	18.52
Mudhole	123,949.88	17.74
Twin Tanks	218,971.88	18.22
Wards	12,453.88	17.76
Dutchman	121,663.63	17.34
Cox-Atkin	290,976.88	17.35
Englestead	256,346.06	17.51
Little Joe	255,210.81	17.38
Bishop and Burr	33,076.38	16.77

5.0 Scales, Mapping Minimums, and Projections

The map/overlay products discussed in this report can be produced to any desired scale and at any specified mapping minimum from 1 acre up. However, it is recommended that mapping minimums of 10 acre or greater be utilized for most products. An example of a management opportunity overlay at several scales is shown in Figures 4-3 through 4-6. Although a Universal Transverse Mercator (UTM) mapping projection has been used up to this time, any mapping projection may be used for the map products.

6.0 Cost Information

Table 6-1 summarizes relative cost information associated with completing similar projects in Alaska, Arizona, and Idaho. The costs are recurring costs which would be encountered in repeating a similar study elsewhere in BLM. These costs are based on completing an analysis on an area of approximately 2.5 million acres. A significant reduction in cost can be realized by working with larger areas in the same environmental strata.

Table 6-1

Cost Analysis of Landsat Data

Product	Cost/Acre
Basic Land Cover Stratification	$0.001 - $0.005
Land Cover Unit with Quantitative Description	$0.01 - $0.05
Production by Major Components	$0.10 - $0.20
Produce Management Opportunity Overlay from Data Base	$0.0001 - $0.001